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ADVANCED DISTRIBUTED SIMULATION TECHNOLOGY ADVANCED ROTARY WING AIRCRAFT

SYSTEM/SEGMENT SPECIFICATION
VOLUME IV of V
SIMULATION SYSTEM MODULE RAH-66 KIT

Loral Systems Company
12151-A Research Parkway
Orlando, FL 32826-3283

31 March 1994

Contract No. N61339-91-D-0001
ARWA - Delivery Order No. 0048
CDRL A00E

Prepared for:

Simulation Training and Instrumentation Command
Naval Air Warfare Center
Training Systems Division
12350 Research Parkway
Orlando, FL 32826-3224

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13. ABSTRACT (Maximum 200 words)

The ADST ARWA System/Segment Specification establishes the functional requirements for the Advanced Rotary Wing Aircraft (ARWA) Simulator System (SS). Volume IV describes the requirements for the Simulator System Module (SSM) with respect to the aircraft specific models for the RAH-66 Comanche aircraft. The RAH-66 Kit component provides aircraft simulation for flight dynamics, flight controls, propulsion, navigation/communication, sensors, aircraft survivability equipment, and weapons.

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1. SCOPE

1.1 Identification. This specification establishes the functional requirements for the Advanced Rotary Wing Aircraft (ARWA) Simulator System (SS).

1.2 Purpose. This specification is intended to define the functional requirements for each of the aircraft simulations and the associated simulator support systems. The aircraft to be simulated are the AH-64D Apache Longbow and the RAH-66 Comanche.

1.3 Introduction. The ARWA SS provides the capability to engage in simulated war fighting exercises within the Distributed Interactive Simulation (DIS) environment for the purpose of rapidly exploring tactics, doctrine and combat system development issues. The ARWA SS consists of a number of subsystems including an ARWA Simulator subsystem, a Session Manager subsystem, a Mission Planning subsystem, an After Action Review subsystem, a Semi-automated Forces subsystem, an Operational and Logistics and Support subsystem, and a Development Subsystem. These subsystems communicate via a DIS based Local Area Network (LAN).

The ARWA Simulator Subsystem consists of a number of manned simulation devices which are capable of being reconfigured between AH-64D and RAH-66 rotary wing aircraft. The simulation devices are real-time, software intensive, network interoperable simulators capable of supporting both hardware and software reconfiguration to the two aircraft models. The ARWA simulator devices simulate the aircraft functions needed to move, shoot, communicate, rearm, and resupply, to the level of fidelity defined in this specification. The software simulation is data driven to provide easy access to critical parameters for modification purposes in an experimentation environment.

The Simulation System Module (SSM) is one of three major components in an ARWA simulator device. The SSM component provides aircraft simulations for flight dynamics, flight controls, propulsion, navigation/communication, sensors, aircraft survivability equipment (ASE), and weapons and associated simulator support systems including physical cues, environment and simulator control.

2. APPLICABLE DOCUMENTS

2.1 Government Documents. The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

PMT-90-W008	Statement of Work, Rotary Wing Aircraft (RWA) Experimental AIRNET Simulators
ATZQ-TDS-SM	Memorandum for PM TRADE, ADST RWA SOW, Captain Major
MIL-STD-1815A 1983	ADA Programming Language
MIL-STD-1777	Internet Protocol Specification
MIL-T-23991	Training Devices, Military; General Specification for
MIL-STD-454	Standard General Requirements for Electronic Equipment

MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment and Facilities
FED-STD-595	Colors
MIL-H-46855	Human Engineering Requirements for Military Systems, Equipment and Facilities
MIL-STD-483	Configuration Management Practices for Systems, Equipment, Munition and Computer Programs

2.2 Non-Government Documents. The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

ANSI X3.148-1988	FDDI-Physical Layer Protocol
ANSI X3.166-1989	FDDI-Physical Layer Medium Dependent
ANSI X3.139-1987	FDDI-Token Ring Media ._. Control
ANSI X3T9.5/84-49	FDDI-Station Management Rev 5.0 draft
PEI 89-103 Rev 3.4	Xpress Transfer Protocol for draft copy - XTP Protocol Definition Protocol Engines, Inc. Santa Barbara, CA
7S4-1985	IEEE Floating Point Specification
IEEE 802.2	IEEE Logical Link Control Specification

3. REQUIREMENTS

3.1 System Definition. This specification defines the requirements for the development and test of the Advanced Rotary Wing Aircraft (ARWA) Simulator System (SS). This System is intended to provide the capability to engage in simulated war fighting exercises on the Battlefield Distributed Simulation Development (BDS-D) network for the purposes of rapidly exploring current and emerging tactics, doctrine, and combat development issues. The ARWA SS shall consist of two simulator stations (ARWA devices), with each station capable of being reconfigured between an AH-64D and an RAH-66, a Simulation Manager station, a Management Command and Control station, a Data Base Maintenance station and a Software Maintenance station. Each simulator station shall allow critical experimental parameters, listed in Appendix B, Volume I, to be changed without reprogramming.

3.1.1 System Functions. The ARWA SS software kit specific modules shall be limited to the SSM.

3.1.1.1 Simulation System Module. The System Simulation module is comprised of ten segments: flight controls, flight dynamics, propulsion, navigation/communication, weapons, sensor control, aircraft survivability equipment, physical cues, instructor/operator station and tactical and natural environment. Physical separation of the

segments is not required. All segments except the control and tactical and navigation segments shall be software kit specific.

3.1.1.1.1 Flight Controls Segment. The flight controls segment shall simulate the flight controls for the RAH-66 aircraft. Simulations shall include primary controls, trim, hinge moments, automatic flight controls systems (AFCS), miscellaneous control devices, and toe brakes/anti-skid. The flight controls simulation shall also include the ability to set and/or adjust certain device parameters to include flight controls input sensitivity of pedals, cyclic and collective. Failures due to battle damage should also be provided.

3.1.1.1.1.1 Primary Controls. The surface positions shall be determined from the cockpit control device inputs (cyclic stick, collective stick and directional pedals), AFCS inputs, hydraulic pressures, electrical power, and battle damage data. The primary controls function shall include the simulation and blade pitch (main and tail). The positions of primary control surfaces shall be determined by simulating the linkage to the surfaces.

3.1.1.1.1.1 Control Loading. The control loading system shall drive the primary control input devices (cyclic stick, collective stick) to provide the proper control feel for the pilot. This includes the effects of cyclic trim or force trim. In the case of the RAH-66, only the collective stick and the brake pedals shall require force loading on the controls. This shall include simulation of the artificial feel system and friction, spring forces, deadband, inertia and hysteresis appropriate to each control input device. The force servo closed-loop response shall be stable and rapid enough to provide realistic dynamic feel. The control loading system shall have dynamic responses which are sufficiently realistic to prevent distraction of the pilot.

3.1.1.1.1.2 Flight Director Systems. The Flight Controls segment shall provide a simulation of the Integrated Fire/Flight Control (IFFC) and Coupled Navigation (CNAV) systems on the RAH-66 aircraft.

3.1.1.1.1.3 Automatic Flight Controls System. The AFCS simulation shall provide the capabilities of heading hold, pitch hold, roll hold, attitude hold, hover hold, and velocity stabilization as applicable to the RAH-66. Stability augmentation simulations shall provide improved stability in the pitch, roll and yaw axes by providing aircraft damping. The stability augmentation system shall oppose any deviation in attitude, but shall not return the aircraft to a given attitude or heading. The simulation shall provide for stability augmentation to be engaged at all times in pitch, roll and yaw mode. Sensed rate signals and Central Air Data Computer (CADC) inputs shall be used in determining pitching, rolling, or yawing motion.

3.1.1.1.1.4 Miscellaneous Control Devices. Miscellaneous controls including landing gear positions and landing gear door positions shall be simulated. The normalized positions and states (e.g., open, opening, closed, etc.) of the miscellaneous control devices shall also be determined.

3.1.1.1.2 Flight Dynamics Segment. The Flight Dynamics segment shall provide for a realistic simulation of the flight characteristics of the RAH-66 aircraft. The simulation shall include portions of the flight envelope which reflect combat operations such as: cruise, ascent, descent, hover, low-level flight, approach and landing within a refueling/rearmament zone and subsequent takeoff from that zone. The simulation shall reproduce fidelity of flight operations to a level which will closely resemble that of the RAH-66 aircraft and which will not cause either distraction of the pilot or an increase or decrease in the performance of the air vehicle to an extent that would affect combat effectiveness or associated test results. The simulation shall include forces and moments,

equations of motion, weight and balance, envelope violation, aerodynamics and ground handling. The flight dynamics simulation shall also include the ability to set and/or adjust certain device parameters to include maximum speed, pitch, roll and yaw rates, turning radius, number of blades, tail rotor effect on performance, failures from combat damage, weight limitations, external weapons selection, wing stores, and internal stores configuration.

3.1.1.1.2.1 Forces and Moments. Aerodynamic forces and moments acting on damaged or undamaged aircraft, ground handling and propulsive forces and moments (including gyroscopic moments) shall be simulated. Forces and moments calculations shall be based on the configuration of the aircraft including location, center of gravity (CG), weight, and moments of inertia of all external stores and internal fuel tanks. Internal calculations from the forces and moments function of the Flight Dynamics segment shall also include stores release, weapons firing effects and battle damage. Body-axis forces and moments due to the aircraft propulsion system including gyroscopic moments shall be calculated based on engine thrust forces. Dynamic modeling of engine moments of inertia is not required. Simulation of forces and moments due to flow field effects while in the proximity of other aircraft is not required.

3.1.1.1.2.2 Equations of Motion. The equations of motion function shall determine the state of the aircraft. The state of the aircraft shall include translational accelerations, velocities, and positions; and rotational accelerations, velocities and positions. The state of the aircraft shall be provided in the earth axis coordinate system to the global bus for network distribution.

3.1.1.1.2.3 Weight and balance. Mass properties information about the aircraft configuration shall be included in the flight dynamics simulation. This information shall include basic aircraft dry weight configuration data, fuel data, and weapon stores data. Data is defined as type and location, weight, CG (x, y and z body-axis locations) and products and moments of inertia of each component. Internal data about the dry aircraft shall be combined with fuel quantities per tank, cargo data and weapons stores data to determine aircraft weight, CG position and products and moments of inertia.

3.1.1.1.2.4 Envelope Violation. Critical flight parameters of the simulated aircraft shall be monitored to determine if structural capacities of the aircraft have been exceeded resulting in a crash condition. The crash conditions shall include exceeding aircraft structural limitations in flight, excessive vertical velocities and excessive side velocities at touchdown. A crash override capability is not required. The simulation shall be able to re-initialize from a crash condition when commanded by the Control segment.

3.1.1.1.2.5 Aerodynamics. Modeling of the aircraft and rotor aerodynamic forces and moments shall be provided. This shall include those effects generated by the airframe, main and tail rotors and stores during hovering and dynamic flight. The aerodynamics modeling shall reflect aircraft operation throughout the entire flight envelope including battle damage. Aerodynamic forces and moments due to weapon damage and/or soft crash (i.e., auto-rotate landing) shall be based on severity and location of damage. The simulation shall reproduce fidelity of flight operations to a level which will closely resemble that of the RAH-66 aircraft and which will not cause either distraction of the pilot or an increase or decrease in the performance of the air vehicle to an extent that would affect combat effectiveness or associated test results. Flow field effects (aerodynamic interaction) due to proximity to other aircraft or weapons is not required. Operation in high normal load factor (high G) environments is not required.

3.1.1.1.2.6 Ground Handling. A simplified model of the aircraft ground handling shall be provided. This modeling shall be limited to a simulation of aircraft ground contact in the vertical direction with no movement along the ground.

3.1.1.1.3 Propulsion Segment. The Propulsion segment shall provide the simulation of the engines and torque generation capabilities for the RAH-66 aircraft. This simulation shall include the core engine modeling, torque generation, transmission system, oil and fuel systems for the T800 engines installed on the RAH-66. The following paragraphs describe the required assumptions and simplifications for level of fidelity:

a. Simulation of engine start characteristics is not required. The engines shall initialize to the level required to produce 100% rotor speeds at flat pitch torques.

b. Simulation of engine bleed air and anti-ice characteristics is not required.

c. Auxiliary and/or secondary power units shall not be simulated.

3.1.1.1.3.1 Core Engine System. Propulsion data shall be provided to the Flight Dynamics segment to propel the aircraft and to the Flight Station module to drive the active propulsion displays and instrumentation. The turbine gas temperature, turbine speed and rotor speed shall be modeled as a function of power demands from the pilot's controls. The rotor speed demands and throttle settings shall be a constant value of 100%. Ambient pressure and ambient temperature effects on engine performance shall be simulated by standard temperature and pressure correction factors. The simplified algorithms shall provide instrument indications which are representative of those in the aircraft.

3.1.1.1.3.2 Torque Generation. The Torque Generation function shall provide outputs to the Flight Dynamics segment to propel the aircraft and to the Flight Station module to drive the flight deck indicators. Simulation of engine fault codes for display on flight deck indicator is not required. Torque shall be simulated in the 21 to 130 percent range.

3.1.1.1.3.3 Engine Fuel System. Engine fuel depletion shall be simulated as a straight line model based on torque.

3.1.1.1.3.4 Transmission System. Accessory drive and transmission gear losses shall be constant in the simulation.

3.1.1.1.3.5 Engine Oil System. The Engine Oil system simulation shall provide a constant oil pressure indication except for battle damage conditions.

3.1.1.1.4 Navigation/Communication Segment. The Navigation/Communication segment shall provide the navigation and communication simulations for the RAH-66 aircraft. These simulations shall include the Inertial Reference System, Doppler Navigation System (DNS), Global Positioning System (GPS), Radar Altitude, Intercommunications System (ICS), VHF communications, UHF communications, HF communications, Air Data System (ADS), and Airborne Target Handover System (ATHS). The following paragraphs describe the requirements that apply to the navigation and communications equipment simulated.

3.1.1.1.4.1 Radio Navigation Aid System. The ASN-137 Doppler Navigation System (DNS) will be controlled through the RAH-66 Display Units. Simulation of DNS accuracy degradation due to altitude and high pitch and roll angles is not required. The Navigation mode of the ASN-137 model shall be functional. Modes such as backup, Hover Bias

Calibration, and Test modes are not required. All display pages shall be accessible through the proper use of key selections and data entry and the display shall be simulated. Navigation data required to provide steering commands shall be dependent upon pilot data entry. Simulation of the Fault Detection/Location System (FD/LS) function is not required.

A generic GPS shall be modeled to provide accurate position and velocity information for use by other systems.

3.1.1.1.4.2 Communications. The following radio communications equipment shall be simulated on the RAH-66: ICS C-11746/ARC, ARC-186 VHF FM-AM (Pilot and Co-pilot/gunner CPG), and ARC-164 UHF. Voice reception from crewmembers and other vehicles shall be possible at all times as long as the receiver select switches on the control panels are on and the volume is turned up. The simulation shall provide for monitoring of up to five radios. Nav audio (Automatic Direction Finder (ADF) or Identification Friend or Foe (IFF)) monitoring are not required. Insertion of static and noise due to equipment interference, atmospheric conditions, or range is not required. The ability to receive communications shall be dependent on line of sight and proper operation of the control panel selections. The simulator communication system design shall be in accordance with best commercial practices and shall replicate the communication system of the application aircraft to the fidelity required to support the simulator mission.

3.1.1.1.4.3 Air Data System (ADS). The simulation of the ADS shall provide the signals for calibrated and indicated airspeed and height above mean sea level as required by other aircraft systems. The ADS shall be modeled as always "on". Simulation of fault detection and isolation is not required. Simulation of air data outputs shall be perfect unless skewed by battle damage or adaptability parameters.

3.1.1.1.4.4 Airborne Target Handover System (ATHS). The ATHS shall be simulated and shall interface properly through the Communications system. ATHS communications shall be possible between all appropriately equipped entities in the DIS exercise.

3.1.1.1.5 Weapons Segment. The Weapons segment shall simulate all ownship weapons and weapon systems. The Weapons segment shall determine the ownship combat damage sustained as function of weapon proximity and detonation characteristics as defined by the DIS environment. The following limitations apply to Weapon segment functions.

a. All weapons are operable, armed, and ready after loading.

b. Crew functions associated with prelaunch stores management shall not be simulated.

c. Crew functions associated with postlaunch stores management shall not be simulated.

d. All necessary power is available, and all equipment is powered on.

3.1.1.1.5.1 Ownship Fire Control. The Weapons segment shall simulate the various effects of aircraft attitude and systems states at weapon launch and shall simulate the specific firing envelope for each weapon. The fire control capabilities of the RAH-66 fire control computer shall be simulated.

3.1.1.1.5.2 Ownship Weapon Dynamics. The Weapons segment shall simulate the flight of ownship released weapons. This simulation shall support internal and ownship guidance. This simulation shall represent the weapon projectile as a point located at the

projectile's center of gravity. The simulation shall represent the projectile in 5 degrees of freedom. The simulation shall represent the projectile mass as a constant during flight. It shall not support a full aerodynamic model. The Weapons segment shall provide simulation of the 20mm gun, Hellfire missiles with infrared (IR), radio frequency (RF) and Laser seekers, 2.75" rockets with various warheads, and Stinger air-to-air missiles. The simulation level of fidelity shall be sufficient to accommodate the adaptability parameters defined in Appendix B, Volume I.

3.1.1.1.5.3 Ownship Weapon Stores. The Weapons segment shall simulate the stores limitations for the RAH-66 aircraft and associated weapons. The Weapons segment shall simulate a dynamic inventory of ordinance based on load, firing, jettison and reload.

3.1.1.1.5.4 Target Designation. The Weapons module shall simulate the interface with the target designation capabilities of the ownship Sensor Control segment and with other ships in the DIS environment.

3.1.1.1.5.5 Ownship Combat Damage. The Weapons segment shall determine the damage to the RAH-66 from detonation of ordinance and shall generate a level of severity for each detonation. Each segment shall simulate the specific effect of the detonation as appropriate for the location and severity for each detonation. The damage shall take on the following forms: airframe distortion affecting flight and/or loss of specific aircraft systems (weapons, aircrew survivability, engines, etc.). Airframe distortion shall be localized to fuselage, tail, rotor, nose, or landing gear.

3.1.1.1.6 Sensor Segment. The Sensor segment shall simulate the sensor control for the Night Vision Pilotage System (NVPS) and Target Acquisition System (TAS) in the RAH-66 aircraft. The Sensor segment simulations shall include mode and parameter control, sensor pointing and dynamics, tracking and track loss, target detection, and target analysis.

3.1.1.1.6.1 Mode and Parameter Control. The mode and parameter control function shall simulate the sensor sight, acquisition and video capabilities of the NVPS and TAS for the RAH-66 aircraft. This function shall provide the interface between the sensor related cockpit controls and the Visual module.

3.1.1.1.6.2 Sensor Pointing and Dynamics. The sensor pointing and dynamics function shall simulate the pointing modes, slew rates and limits, and stabilization of the sensor turrets for the RAH-66 aircraft. For the purposes of simulation the turret servos are considered to be critically damped with no oscillations. This function shall determine the line of sight (LOS), field of view (FOV) and field of regard (FOR) for each of the simulated sensors.

3.1.1.1.6.3 Tracking and Track Loss. The tracking and track loss function shall simulate the tracking capabilities of the RAH-66 aircraft. Tracking simulation shall be implemented with simplified prediction, measurement and correction algorithms. Intermittent track loss and reacquisition shall be simulated through probabilistic methods. Complete track loss shall also be simulated.

3.1.1.1.6.4 Target Detection. The target detection function shall simulate the detection process by selecting which targets in the sensor field of regard (FOR) shall be identified for target recognition processing. The detection process shall be probabilistic and based on range to target and associated signal attenuation. For the purposes of simulation target aspect angle, atmospheric refraction, degraded sensor resolution and modulation transfer function loss factors are not required in the probability calculation. The simulation shall

include pseudo-random generation of sensor "false alarms" and management of a "no target" list. This function shall identify the target or terrain feature requiring track when an automatic tracking mode is engaged. Laser range finding and designation shall also be simulated.

3.1.1.1.6.5 Target Analysis. The target analysis function shall simulate the classification process of the target recognition capability for the RAH-66 aircraft. Classification shall be an extension of the probabilistic methods used in target detection. The target analysis model shall be parameterized to permit incorporation of simulated recognition and identification capabilities when required.

3.1.1.1.7 Aircraft Survivability Equipment (ASE) Segment. The ASE segment shall provide real-time simulation and modeling of ASE equipment types (e.g. warning systems, jamming systems, and expendable systems) onboard the RAH-66 aircraft. Equipment shall be simulated in accordance with design criteria and interfaces provided as required to other segments with the following exceptions:

a. Simulation of anomalous processing and display effects due to high signal power and high signal density are not required.

b. Signal propagation shall be influenced by Nap of the Earth (NOE) according to 4/3 earth curvature algorithms along with terrain and feature masking for objects provided in the Engineering Topographic Laboratory (ETL) data base. Simulation of signal propagation effects due to obscurants/dynamic weather is not required.

c. Onboard equipment field of view (FOV) shall be provided through main beam and backlobe patterns. The main beam angular width shall be defined as the angular portion of the beam that is within 6 db of the peak value.

d. Capability shall be provided in a pre-mission (i.e. non-real-time) environment for efficient modification of equipment critical processing parameter limits such as frequency, power output, and field of coverage. See Appendix B, Volume I.

e. Simulation of equipment malfunctions due to combat damage effects shall be provided.

3.1.1.1.7.1 APR-39 Radar Warning Receiver (RWR) System. The APR-39 RWR system simulation shall be capable of generating simultaneous visual effects of up to eight (8) signals and aural effects of up to five (5) signals. It shall provide the flexibility to generate any type of signal or combination of signals typical of threats in a ARWA environment within the aforementioned limitations. The following capabilities shall be provided:

a. Simulation of receiver system characteristics such as detection range and parameter limit detection (RF, pulse repetition frequency (PRF), and PW).

b. Simulation of processor characteristics shall be simulated such as algorithms for angle of arrival, direction finding and emitter identification via parameter matching. Priority processing shall be provided, as necessary, for the visual and aural simulation limits.

c. Missile detection activity shall be provided but crossband correlation

simulation is not required. Missile tones shall have the proper audio tone, volume, and frequency.

d. Four (4) distinct threat signal audio tone types shall be provided to simulate audio tone, volume, and frequency(s) sufficient to permit threat mode classification to four types of operating modes (search, acquisition, track, launch) by the crewmember. Specific signal identification to a North Atlantic Treaty Organization (NATO) code name is not required.

e. The display and audio characteristics of multiple threat systems of the same NATO code name shall not appear synchronized.

f. Effects of PRF and scan synchronization of multiple signals or other interactive effects between threat systems in the network shall not be simulated.

3.1.1.1.7.2 AVR-2 Laser Warning Receiver (LWR) System. The AVR-2 LWR system simulation shall be capable of generating simultaneous visual effects and aural effects of signals as interfaced through the APR-39 RWR simulation. It shall represent signals or combinations of signals typical of threats in a ARWA environment. The following capabilities shall be provided:

a. Simulation of receiver system characteristics such as detection range and parameter limit detection (LF, LPRF, and LPW).

b. Simulation of processor characteristics shall be simulated such as algorithms for angle of arrival, direction finding and Laser emitter identification via parameter matching. Priority processing shall be provided, as necessary, for the visual and aural simulation limits.

c. Threat signal audio tones shall have the proper audio tone, volume, and frequency (s) to permit signal/mode type recognition by the crewmember. Specific signal identification to a NATO code name is not required.

3.1.1.1.7.3 Radiological Warning System (RWS). The RWS simulation shall be capable of providing both visual and aural cockpit alerts, as appropriate, for impending radiological agents in the environment as determined by the interface to the DIS network protocol structure.

3.1.1.1.7.4 Chemical Warning System (CWS). The CWS simulation shall be capable of providing both visual and aural cockpit alerts, as appropriate, for impending chemical agents in the environment as determined by the interface to the DIS network protocol structure.

3.1.1.1.7.5 ALQ-136 Radar Jammer. The ALQ-136 Radar Jammer system simulation shall be capable of interfacing with up to ten (10) simultaneous signals. The following capabilities shall be provided:

a. Simulation of receiver system characteristics such as detection range and parameter limit detection (RF, PRF, and PW).

b. Simulation of processor characteristics shall be simulated such as algorithms for angle of arrival, direction finding and emitter identification via parameter matching. Priority processing shall be provided, as necessary, for the

simulation limits.

c. Simulation of RF jamming characteristics shall be simulated to the extent necessary to provide the interface into the DIS network protocol structure.

3.1.1.1.7.6 ALQ-144 Infrared (IR) Jammer System. The ALQ-144 IR jammer system simulation shall provide simulation of IR jamming characteristics (power, frequency(s), field of view) to the extent necessary to provide the interface into the DIS network protocol structure.

3.1.1.1.7.7 M-130 Chaff System. The M-130 chaff system simulation shall be capable of providing the following capabilities:

a. Simulation of loading M-1 chaff either during mission initialization or when "resupply" is requested by the DIS network. The chaff counter shall be operable to indicate inventory remaining.

b. Simulation of manual initiation of chaff program. Both manual and program chaff release types shall be operable.

c. Simulation of chaff dispense program parameters (e.g. SALVO, BURST).

d. Simulation of dispensed chaff cloud characteristics to the extent necessary to provide the interface into the DIS network protocol structure.

3.1.1.1.7.8 M-130 Flare System. The M-130 flare system simulation shall be capable of providing the following capabilities:

a. Simulation of loading M-206 flares (up to 30 cartridges) in the Payload module either during mission initialization or when "resupply" is requested by the DIS network.

b. Simulation of manual initiation of flare program. Both manual and program flare release types shall be operable.

c. Simulation of flare dispense program parameters (e.g. SALVO, BURST).

d. Simulation of dispensed flare characteristics to the extent necessary to provide the interface into the DIS network protocol structure.

3.1.1.1.8 Physical Cues Segment. The Physical Cues segment shall simulate the environmental sounds, navigation system tones and threat audio tones for each of the RAH-66 aircraft. The simulated sounds shall include engines, rotors, small arms impacts, ownship weapons firings and weapon detonation,. Simulated tones shall include aircraft warning system synthetically generated tones, radar induced tones, and navigation systems tones. The spectral content and loudness levels of these sounds and tones shall be dynamically controlled to represent realistic responses to simulated events. There shall be no motion system or motion cues provided. The physical cues segment shall provide seat vibration cues representative of the RAH-66 aircraft.

3.2. System Characteristics. The system characteristic requirements for the RAH-66 Kit shall be as specified in Paragraph 3.2 of Volume I of this specification.

3.3. RAH-66 Kit Processing Resources. The System Processing Resources requirements of Paragraph 3.3 of Volume I of this specification shall all to the processing resources of the RAH-66 Kit.

3.4. Quality Factors. The requirements of Paragraph 3.4 of Volume I of this specification shall apply.

3.4.1. Reliability. The requirements of Paragraph 3.4.1 of Volume I of this specification shall apply.

3.4.2. Maintainability. The requirements of Paragraph 3.4.2 of Volume I of this specification shall apply.

3.4.3. Flexibility and Expansion. The requirements of Paragraph 3.4.3 of Volume I of this specification shall apply.

3.4.4. Availability. The requirements of Paragraph 3.4.4 of Volume I of this specification shall apply.

3.4.5. Portability. The requirements of Paragraph 3.4.5 of Volume I of this specification shall apply.

3.5. Logistics. The logistics requirements specified in Paragraph 3.5 of Volume I of this specification shall apply to the RAH-66 Kit.

3.6. Precedence. The precedence requirements specified in Paragraph 3.6 of Volume I of this specification shall apply to the RAH-66 Kit.

4. VERIFICATION REQUIREMENTS

4.1 General. The system level general verification events, levels and methods of testing for the RAH-66 Kit are defined in Volume I of this specification, paragraph 4.1 and all subparagraphs of paragraph 4.1. For the RAH-66 Kit operating in the MSS, there are no additional general verification requirements.

4.1.1 Philosophy of Testing. In addition to the testing philosophy identified in Volume I of this specification, paragraph 4.1.1, informal standalone module testing shall be conducted for the flight station module prior to integration with the system. The intent of these tests shall be to identify and resolve any unique module related deficiencies prior to system integration thus reducing integration problems.

4.1.1.1 Testing Events. Scheduled testing shall take place sequentially in the following phases.

4.1.1.1.1 Verification Test. Verification test at a system level shall be conducted as specified in Volume I of this specification, paragraph 4.1.1.1.1. Module level verification testing shall be accomplished prior to shipment of the module to the integration facility and shall ensure that the module meets the functional and performance requirements of this volume of the specification.

4.1.1.1.2 Acceptance Test. Acceptance test at a system level shall be conducted as specified in Volume I of this specification, paragraph 4.1.1.1.2. Module level acceptance testing shall consist of installation and checkout of the module at the integration facility and accomplishment of a subset of the module level verification tests to ensure that the module

meets the functional and performance requirements of this volume of the specification in the installed configuration.

4.1.2 Location of Testing. All system level testing shall be accomplished in the locations identified in Volume I of this specification, paragraph 4.1.2. All module level verification testing shall be accomplished at the module builders facility. All module level acceptance testing shall be accomplished at the system integration facility.

4.1.3 Responsibility for Tests. The responsibility for system level testing shall be as defined in Volume I of this specification, paragraph 4.1.3. The responsibility for module level testing shall be allocated to the module builder and system integrator.

4.1.4 Verification Methods. Verification methods shall be as defined in Volume I of this specification, paragraph 4.1.4.

4.2 Formal Tests. Formal test shall consist of functional and performance testing.

4.2.1 Performance Evaluation. Performance evaluations which verify the design and development of the configuration items shall be performed to test that the design and performance of the configuration items meet the requirements specified in paragraph 3.1 of this Volume and Volume I of this specification. Performance evaluation shall consist of inspections, analyses, demonstrations and tests.

4.2.3 Reliability and Maintainability. Reliability and maintainability testing shall not be performed.

4.2.4 Test Equipment. Test equipment requirements applicable to all modules are described in Volume I of this specification, paragraph 4.2.4. There is no additional module unique test equipment required to verify that the configuration items and assembled module meet the requirements specified in paragraph 3, Requirements, of this Volume and Volume I of this specification.

4.3 Formal Test Constraints. The formal test constraints for the ARWA SS system are described in Volume I of this specification, paragraph 4.3. There are no additional formal test constraints unique to the RAH-66 Kit.

4.4 Verification Cross Reference. Table 1, RAH-66 Kit Verification Cross Reference Matrix, provides a requirements/verification cross reference guide for the RAH-66 Kit using the definitions provided in Volume I of this specification, paragraph 4.1.4.

Legend: NA-Not Applicable I-Inspection D-Demonstration A-Analysis T-Test						
Section 3 Requirements Reference	Qualification Method(s)					Section 4 Qualification Requirement Reference
	NA	I	A	D	T	
3.	NA					
3.1	NA					
3.1.1	NA					
3.1.1.1	NA					
3.1.1.1.1	NA					
3.1.1.1.1.1				D		4.2.1
3.1.1.1.1.2				D		4.2.1
3.1.1.1.1.3				D		4.2.1
3.1.1.1.1.4				D		4.2.1
3.1.1.1.2	NA					
3.1.1.1.2.1				D		4.2.1
3.1.1.1.2.2				D		4.2.1
3.1.1.1.2.3				D		4.2.1
3.1.1.1.2.4				D		4.2.1
3.1.1.1.2.5				D		4.2.1
3.1.1.1.2.6				D		4.2.1
3.1.1.1.3	NA					
3.1.1.1.3.1				D		4.2.1
3.1.1.1.3.2				D		4.2.1
3.1.1.1.3.3				D		4.2.1
3.1.1.1.3.4				D		4.2.1
3.1.1.1.3.5				D		4.2.1
3.1.1.1.4	NA					
3.1.1.1.4.1				D		4.2.1
3.1.1.1.4.2				D		4.2.1
3.1.1.1.4.3				D		4.2.1
3.1.1.1.4.4				D		4.2.1
3.1.1.1.5	NA					
3.1.1.1.5.1				D		4.2.1
3.1.1.1.5.2				D		4.2.1
3.1.1.1.5.3				D		4.2.1
3.1.1.1.5.4				D		4.2.1
3.1.1.1.5.5				D		4.2.1
3.1.1.1.6	NA					
3.1.1.1.6.1				D		4.2.1
3.1.1.1.6.2				D		4.2.1
3.1.1.1.6.3				D		4.2.1
3.1.1.1.6.4				D		4.2.1
3.1.1.1.6.5				D		4.2.1
3.1.1.1.7	NA					
3.1.1.1.7.1				D		4.2.1
3.1.1.1.7.2				D		4.2.1
3.1.1.1.7.3				D		4.2.1
3.1.1.1.7.4				D		4.2.1
3.1.1.1.7.5				D		4.2.1

Table 1. RAH-66 Kit Verification Cross Reference Matrix

Legend: NA-Not Applicable I-Inspection D-Demonstration A-Analysis T-Test						
3.1.1.1.7.6				D		4.2.1
3.1.1.1.7.7				D		4.2.1
3.1.1.1.7.8				D		4.2.1
3.1.1.1.8				D		4.2.1
3.2		I				4.2.1
3.3		I		D		4.2.1
3.4	NA					
3.4.1				D		4.2.1
3.4.2				D		4.2.1
3.4.3				D		4.2.1
3.4.4				D		4.2.1
3.4.5				D		4.2.1
3.5				D		4.2.1
3.6			A			4.2.1

Table 1. RAH-66 Kit Verification Cross Reference Matrix [Continued]

5. PREPARATION FOR DELIVERY

The preparation for delivery requirements for the ARWA SS are specified in Volume I of this specification, paragraph 5. There are no additional or specific preparation for delivery requirements applicable to the RAH-66 Kit.

6. NOTES

6.1 RAH-66 Kit Acronyms. The acronyms contained in this paragraph are unique to the RAH-66 Kit and are in addition to the ARWA SS acronyms contained in Volume I of this specification, paragraph 6.1.

ADS	Air Data System
ADST	Advanced Distributed Simulation Technology
ADF	Automatic Direction Finder
AFCS	Automatic Flight Control System
ARWA	Advanced Rotary Wing Aircraft
ATHS	Automatic Target Handover System
C	Centigrade
CADC	Central Air Data Computer
CDU	Computer Display Unit
CG	Center of Gravity
CNAV	Coupled Navigation System
CPG	Copilot/Gunner
CWS	Chemical Warning System
DIS	Distributed Interactive Simulation
DNS	Doppler Navigation System
DOD	Department of Defense
ETL	Engineering Topographic Laboratory

FDDI	Fiber Distributed Data Interface
FD/LS	Fault Detection/Location System
FOR	Filed of Regard
FOV	Field of View
GFP	Government Furnished Property
GPS	Global Positioning System
HF	High Frequency
Hg	Mercury (Barometric Pressure)
HWCI	Hardware Configuration Item
ICS	Intercom System
IDD	Interface Design Document
IFF	Identification Friend or Foe
IFFC	Integrated Fire/Flight Control
I/O	Input/Output
IR	Infrared
LAN	Local Area Network
LF	Low Frequency
LOS	Line of Sight
LPRF	Laser Pulse Repetition Frequency
LPW	Laser Pulse Width
LWR	Laser Warning Receiver
MSS	Modular Simulator System
NATO	North Atlantic Treaty Organization
NOE	Nap of Earth
NVPS	Night Vision Pilotage System
PRF	Pulse Repetition Frequency
PW	Pulse Width
RAM	Random Access Memory
RF	Radio Frequency
RWA	Rotary Wing Aircraft
RWR	Radar Warning Receiver
RWS	Radiological Warning System
SOW	Statement of Work
SS	Simulator System
SSM	Simulator System Module
STP	System Test Plan
TAS	Target Acquisition System
TBD	To Be Determined
UHF	Ultra High Frequency
VHF	Very High Frequency
VNET	Virtual Network